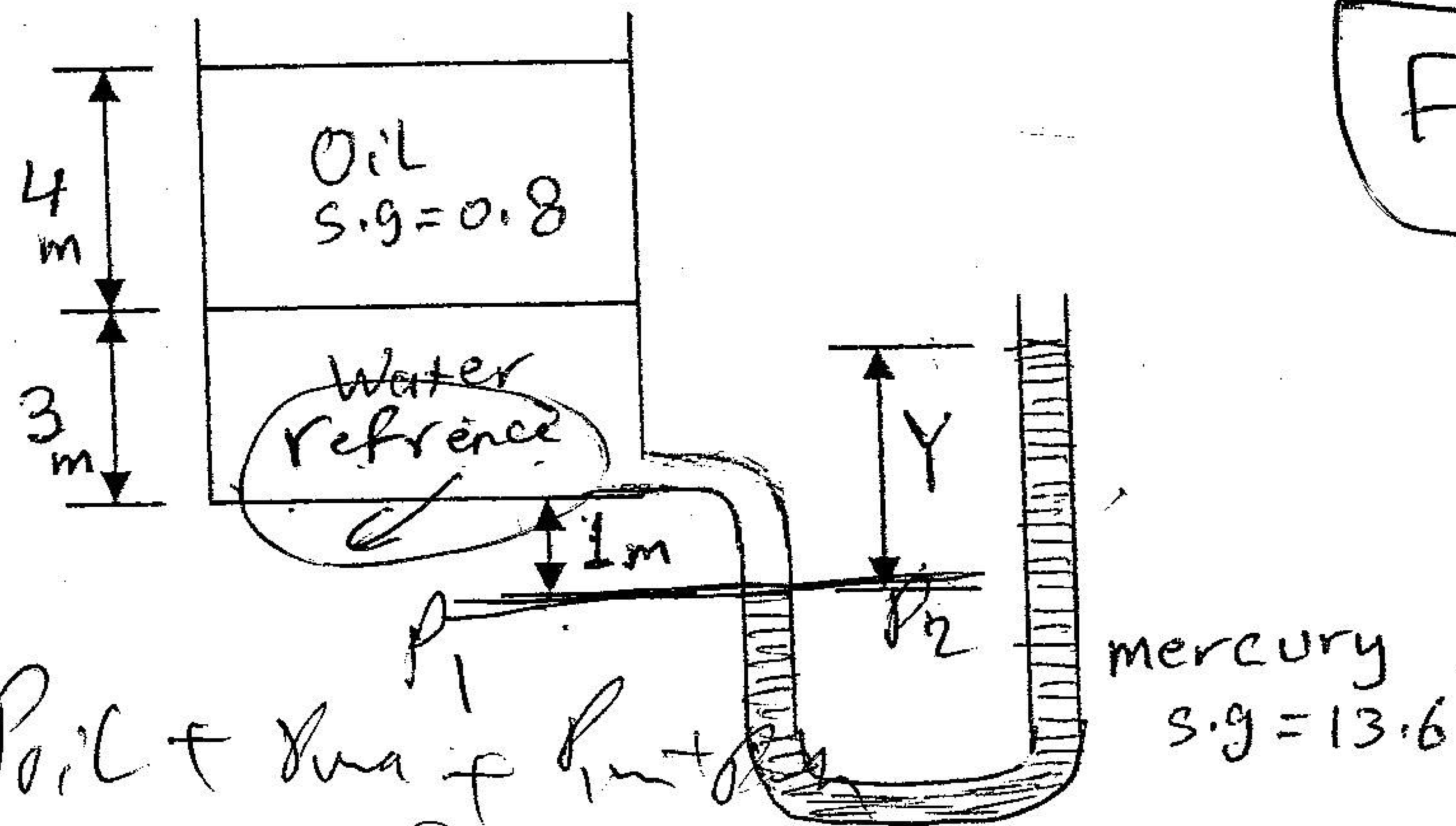
PTU Khadouri | Engineering Faculty
Fluid Mechanics and Heat Transfer | First exam | Time 50 min

St. Name:............

Q1 A manometer is attached to a tank containing two different fluids as shown . find the elevation of the mercury column in the manometer Y. (5 p)

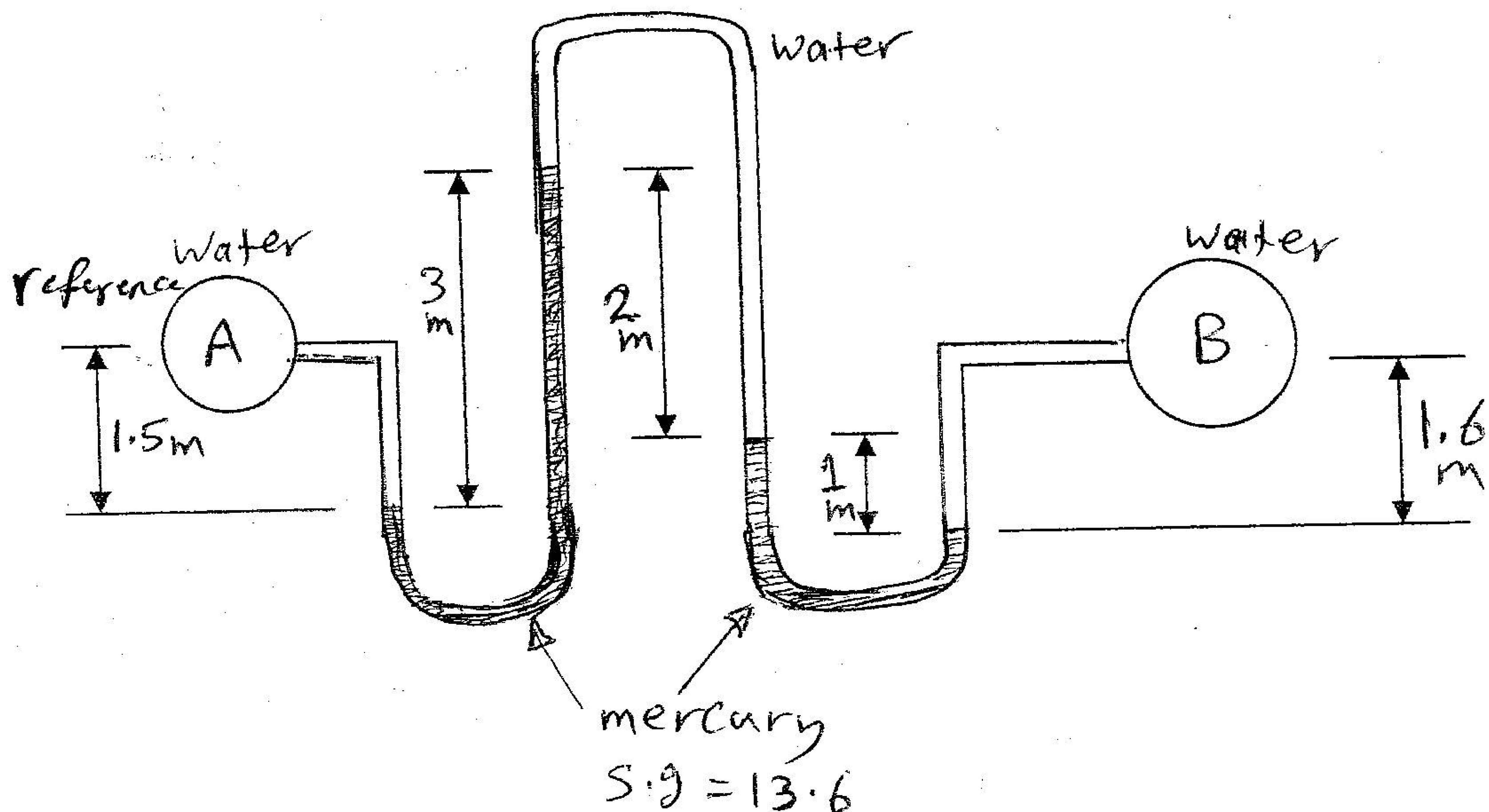
$\gamma_w = 9.79\ KN/m^3$



Fluid First

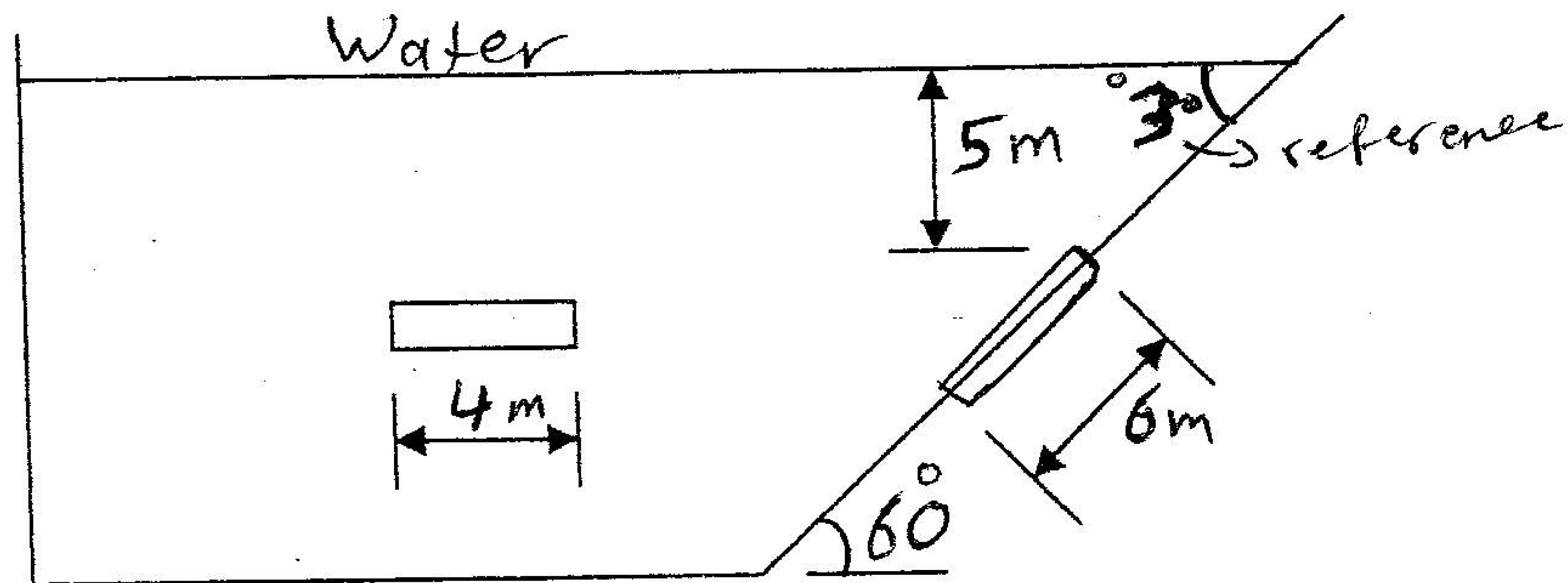
تم الرفع بواسطة
م.معن البوعيسي

Q2 Determine the pressure difference between pipes A and B for the differential manometer shown . (5 p)



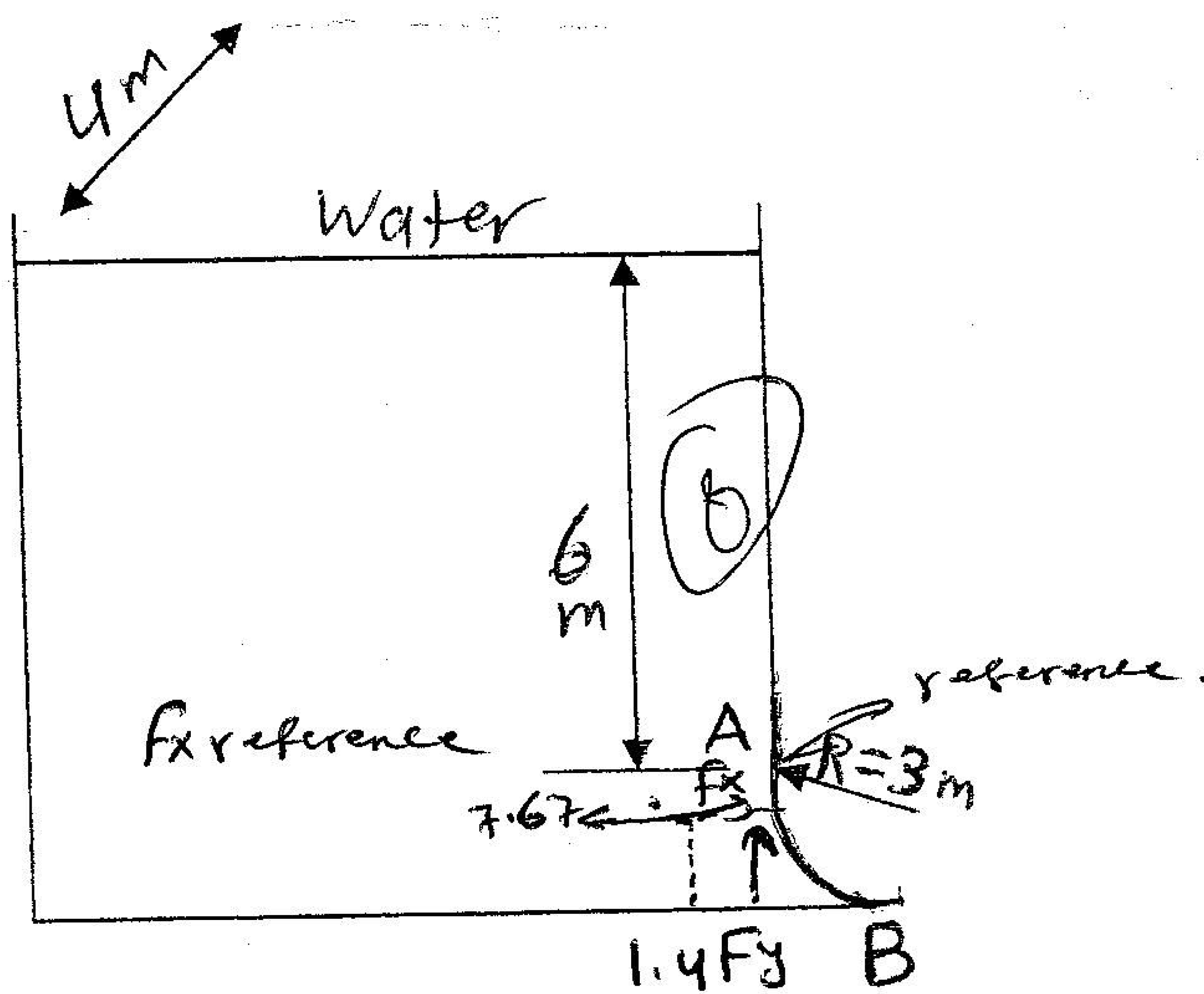
يتبع

Q3 An inclined rectangular gate (4m x 6m) with water on one side as shown. Find the total resultant force on the gate and locate the center of pressure. (6 p)
($I_{cg} = bh^3/12$)



Q4 The submerged curved surface AB is one quarter (1/4) of a circle of radius 3. meter. The water depth is 6meter and the tank width is 4 meters. Determine
1- horizontal and vertical components of the total resultant force acting on curved surface
2-the location of these components (9 p)
($c.g = 4r/3\pi$)

0,09
0.1
$h_{cg} + \frac{I}{A h_{cg}}$
6 (8).



Good Luck

19



هندسة ميكانيكس

[redacted]

Q1 $P_{water} + P_{oil} + P_{atm} = P_{mercury} + P_{atm}$? حسب المرجع الافقي

$9.79 * 4 * 0.8 + 9.79 * 3 + 9.79 * 1 + 13.6 * 9.79\, y = 0$

$\Rightarrow 31.328 + 29.37 + 9.79 = 133.144\, y$

$\Rightarrow 70.488 = 133.144\, y$

$\boxed{\Rightarrow y = 0.529\ m}$

3/5

reference is A

Q2 $P_A + 1.5 * 9.79 - 13.6 * 9.79 * 3 + 2 * 9.79 + 13.6 * 9.79 - 1.6 * 9.79 = P_B$

$\Rightarrow P_A + 14.685 - 399.432 + 19.58 + 133.144 - 15.664 = P_B$

$P_A + 167.409 - 415.096 = P_B$

$\boxed{P_A - P_B = 247.687\ kPa}$

5

$30°$

60

Q3 $h_{cg} = 5 + \frac{1}{2} * 6 \sin 30 = 5 + 1.5 = 6.5$ m

$F = \gamma h A = 9.79 * 6.5 * 24 = 1527.24$ kN

$h_{cp} = h_{cg} + \frac{I_s}{h_{cg} A}$

$\Rightarrow I_s = b h^3 / 12 = \frac{4 * 6^3}{12} = 72 \ m^4$

$h_{cp} = h_{cg} + \frac{72}{6.5 * 24}$

$= 6.5 + \frac{72}{156} = 6.5 + 0.4615 = 6.961$ m

$h_{cp} = 6.961$ m

4/6

Q4 r = 3 m, water depth is 6 meter, width is 4

find F_x, F_y

2 - location of the components

$F_x = \gamma A h_{cg}$

$h_{cg} = 6 + \frac{3}{2} = 6 + 1.5 = \boxed{7.5\ m}$

$F_x = \gamma h_{cg} A = 9.79 * 7.5 * \frac{\pi (3)^2}{4}$

$= \boxed{519.01\ kN}$

projected Area

4 X 3

$F_y = \text{volume} * \gamma$

$= \left((6 * 3 * 4) + \frac{\pi (3)^2}{4} * 4 \right) \gamma$

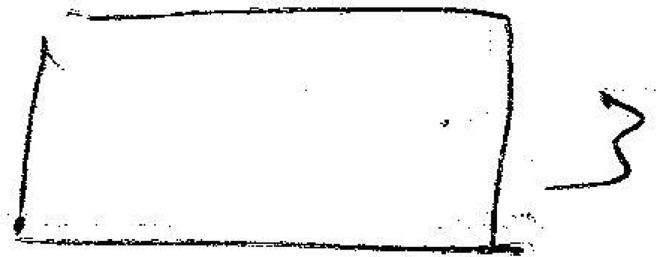
$= (72 + 28.274)\ 9.79$

$\boxed{F_y = 981.68\ kN}$

h_{cp} of F_x =

$h_{cp} = h_{cg} + \frac{I_s}{h_{cg} A} =$

$h_{cp} = h_{cg} + \frac{I_s}{h_{cg} A}$



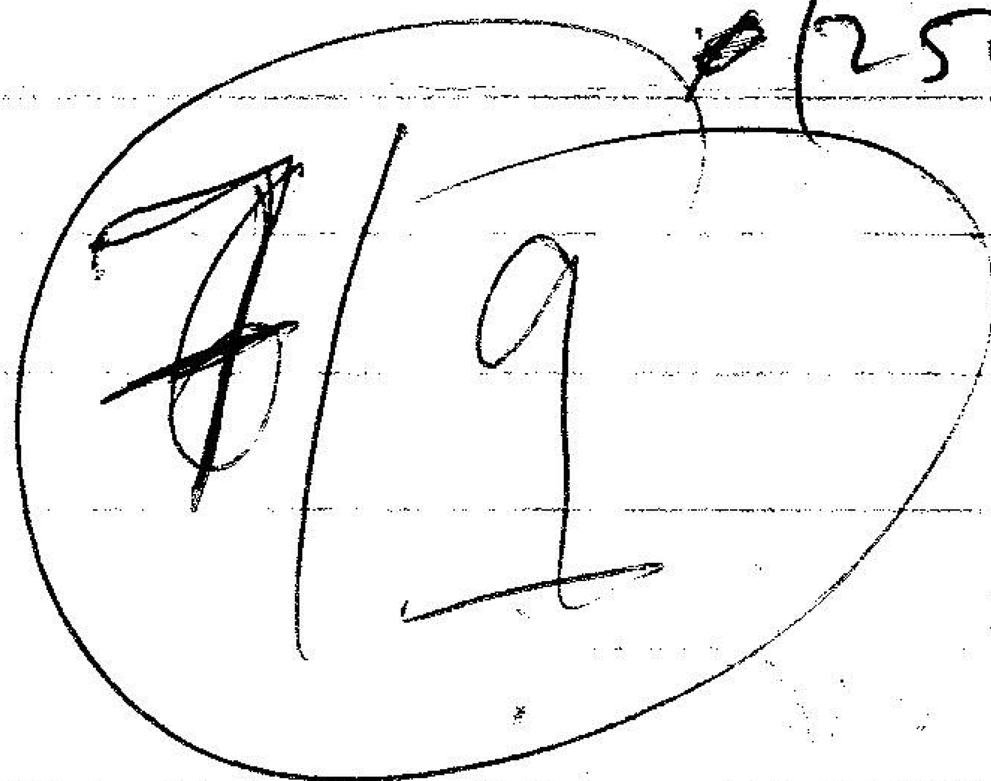
نعتبرها عبارة عن مستطيل $\Rightarrow I_s = \frac{bh^3}{12} = \frac{4 * 3^3}{12} = 16 \, m^4$

$h_{cp} = 7.5 + \frac{16}{7.5 * 12} = 7.6778 \, m$ ⇒ y component

$\bar{X}\left((6*3) + \left(\frac{\pi(9)}{4}\right)\right) = A_1 X_1 + A_2 X_2$

$\bar{X}(18 + 7.0685) = (6*3*1.5) + \left(\frac{\pi(9)}{4}\right)\left(\frac{4*3}{3\pi}\right)$

$(25.0685)X = 27 + 9$



$25.0685X = 36$

$\Rightarrow X = 1.436065$

B تبعد عن النقطة